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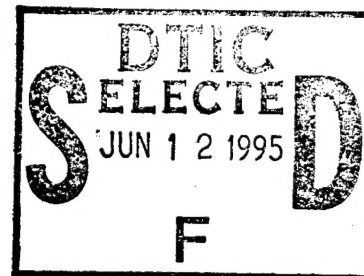


**FACILITIES ENGINEERING
APPLICATIONS PROGRAM**

USER'S GUIDE

USER'S GUIDE: SLURRY SEAL

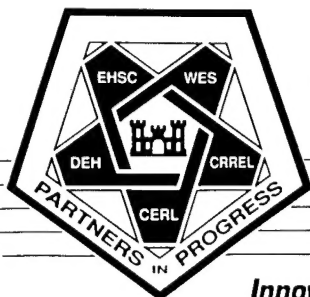
by



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1 Executive Summary

Description

Many of the U.S. Army pavements are currently experiencing surface deficiencies which reduce pavement life and safety while increasing life cycle costs. These pavement surface deficiencies include rutting, cracking, raveling and reduced skid resistance. The slurry seal maintenance procedure is a viable solution to these current pavement problems.

Slurry seal is a mixture of emulsified asphalt, fine aggregate and mineral filler, with water added to produce a slurry consistency. Mixing these ingredients in the proper proportion produces a homogeneous fluid-like mixture that can be squeegeed over an existing pavement. A thick, hard, dense asphalt concrete paving surface results after evaporation of the water and curing of the asphalt.

Application

Slurry seal is used as a crack filler, as a surface sealer and wearing surface, and to improve skid resistance.

Benefits

Slurry seal can be used as a crack filler on most pavements. Small clean surface cracks on sound pavements (less than 1/8 in. wide) can be successfully treated. Large or deep cracks need to be individually treated prior to application of a slurry seal.

As a surface sealer and wearing surface, slurry seal can be used to cover and seal pavements that are raveling, wearing, or oxidizing.

Slurry seal improves skid resistance of slippery pavement when properly designed and constructed.

Limitations

Slurry seal cannot be used to rehabilitate structurally unsound pavements. AC pavements that contain alligator cracking or weak base courses and PCC pavements with shattered or failed slabs must be repaired prior to using slurry seal.

Costs

Proper use of a slurry seal maintenance program is estimated to reduce the life cycle cost of a newly constructed asphalt concrete pavement by approximately 20 percent.

Recommendation for Use

Slurry seal can be used as a pavement maintenance material to fill cracks, provide a wearing surface or surface seal, and improve skid resistance; but it is not a "cure all" as a pavement maintenance material. In general, only a structurally sound pavement with low-to-moderate amounts of traffic should be selected.

Points of Contact

Points of contact regarding this technology are:

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2 Preaquisition

Description of Slurry Seal

Many U.S. Army pavements are currently experiencing surface deficiencies which reduce pavement life and safety while increasing life cycle costs. These pavement surface deficiencies include rutting, cracking, raveling and reduced skid resistance. The slurry seal maintenance procedure is a viable solution to these current pavement problems.

Slurry seal is a mixture of slow setting emulsified asphalt, fine aggregate and mineral filler, with water added to produce a slurry consistency. Mixing these ingredients in the proper proportion produces a homogeneous fluid-like mixture that can be squeegeed over an existing pavement. A thick, hard, dense asphalt mat results after evaporation of the water and curing of the asphalt. This mat seals the pavement surface from chemical effects, such as weathering (oxidizing), and from physical effects, such as traffic abrasion and raveling and reduces surface water intrusion. Resistance to traffic abrasion is improved if the proper aggregate gradation and crushed aggregate are used.

Properly designed and constructed slurry seals can improve the skid resistance of a slippery pavement if the proper aggregate is used. The skid resistance is improved if the aggregate has a sharp angular shape and is polish resistant. Aggregate that has a history of poor skid resistance should not be used.

Slurry seal can be used as a crack filler on most pavements, but there are limitations. Small surface cracks on sound pavement can be successfully treated, but cracks due to an inadequate pavement structure or excessive pavement movement are generally not successfully treated because the active or reflective cracks will quickly reappear.

Slurry seal is best utilized for sealing or filling clean small (less than 1/8 in. wide) surface cracks. Large or deep cracks need to be individually treated prior to application of a slurry seal.

Proper design and application (Godwin 1975) are very important for obtaining a satisfactory job. Generally, life expectancy of the slurry seal is 2 to 5 years. A continuous mix slurry machine, spreader box, and a pneumatic-tired compaction roller are used to apply slurry seal.

Slurry seal should be applied in thin layers (generally 1/4 in. thick) when the ambient temperature is above 60°F and when there is no danger of rain. Cold temperatures or wet conditions slow and sometimes stop the curing process. Sufficient curing time (possibly as long as 24 hr is needed when using slow-set emulsions) must be allowed before opening the slurry seal to traffic.

Application

Slurry seal is used as a crack filler, as a surface sealer and wearing surface and to improve skid resistance. It is better suited for a pavement subjected to low or moderate traffic. Heavy traffic can cause rapid deterioration of the thin layer. Only structurally sound pavements are suited for a slurry seal.

Limitations/Disadvantages

Slurry seal cannot be used to rehabilitate structurally unsound pavements. AC pavements that contain alligator cracking or weak base courses and Portland Cement Concrete (PCC) pavements with shattered or failed slabs must be repaired prior to using slurry seal. Uncured slurry seal is very susceptible to changes in weather conditions. A treated pavement must be closed to traffic to allow the slurry seal to cure, sometimes for as long as 24 hr. Heavy traffic can cause rapid deterioration of the thin layer.

FEAP Demonstration/Implementation Site

One demonstration project was conducted in 1993. This project was located at Castle AFB, CA. One area was originally a concrete parking apron which is now being used for a street and parking area. The area to be slurry sealed was being used for a street and carried moderate traffic. It was severely cracked and spalled. The area was first cleaned, swept, and debris removed from cracks. A first application was applied over the entire area to fill cracks and spalled areas. After curing for 4 hrs a second application, which was approximately 1/4 in. thick, was applied. After this application cured traffic was allowed to return to the area. Another portion of this street was slurry-sealed using this method approximately three years ago and is performing satisfactorily.

The second area slurry-sealed was located in the base housing area. This area was an asphalt concrete pavement that was structurally sound but did have a large number of surface cracks. Slurry seal was applied in one application of approximately 1/4 in. thick and allowed to cure.

All work was accomplished in accordance with requirements of contract specifications and comply with the International Slurry Surfacing Association "Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal Surfacing," Standard A105, dated January 1986.

Life-Cycle Costs/Benefits

Proper use of a slurry seal maintenance program is estimated to reduce the life cycle cost of a newly constructed asphalt concrete pavement by approximately 20 percent. It is also estimated that the U.S. Army currently spends approximately 20 million dollars annually for pavement maintenance and rehabilitation. Assuming that 5 percent of typical maintenance or rehabilitation procedures could have been candidates for slurry seal treatments, then the U.S. Army could save at least $\$20,000,000 \times .20 \times .05 = \$200,000$ annually with an Army-wide slurry seal maintenance program.

3 Acquisition/Procurement

Potential Funding Sources

Typically, installations fund the implementation of pavements and railroads technologies out of their annual budgets. However, the annual budget is always underfunded and normally the pavements and railroads projects just do not compete well with other high visibility/high interest type projects. As a result, it is in your best interest to seek all of the funds possible from other sources when the project merits the action. Listed below are some sources commonly pursued to fund projects.

- a. *Productivity program.* See AR 5-4, Department of the Army Productivity Improvement Program for guidance to determine if the project qualifies for this type of funding.
- b. *Facilities Engineering Applications Program (FEAP).* In the past, a number of pavement and railroad maintenance projects located at various installations were funded with FEAP demonstration funds. At that time, emphasis was placed on demonstrating new technologies to the Directorate of Engineering and Housing (DEH) community. Now that these technologies have been demonstrated, the installations will be responsible for funding their projects through other sources. However, emphasis concerning the direction of FEAP may change in the future; therefore, do not rule out FEAP as a source of funding.
- c. *Special programs.* Examples of these are as follows:
 - (1) FORSCOM mobilization plant which may include rehabilitation or enlargement of parking areas and the reinforcement of bridges.
 - (2) Safety program which may include the repair of unsafe/deteriorated railroads at crossings and in ammunition storage areas.
 - (3) Security upgrade which may include the repair or enlargement of fencing.

- d. Reimbursable customer.* Examples of this source are roads to special function areas such as family housing or schools and airfield pavements required to support logistical operations.
- e. Special requests from MACOMS.*
- f. Year end funds.* This type funding should be coordinated with the MACOMS to ensure that the funds will not be lost after a contract is advertised.
- g. Operations and Maintenance Army.* These are the normal funds used for funding pavement and railroad projects.

Technology Components and Sources

Components of this technology which must be procured for slurry seal are project design (may be accomplished in-house or contracted out), contractor or in-house crew to perform pavement preparation and slurry seal application.

All of the items used in slurry seal are conventional materials and procedures; therefore, no special materials or procedures are required.

Procurement Documents

- a. U.S. Army Corps of Engineers (1991).*
- b. Department of the Army, TM 5-822-8, Bituminous Pavement Standard Practice, July 1987.*
- c. Department of the Air Force, AFM 88-6, Bituminous Pavements Standard Practice, July 1987.*

Procurement Scheduling

Normal construction contract schedules should be established that would allow adequate design and plan preparation time; design, review and approval; contract preparation; advertising and award; and construction time. A typical project may be designed 1 to 2 years before it is constructed; however, relatively small projects that require limited plans and specifications can be prepared and ready to go within a few months.

4 Postacquisition

Initial Implementation

Equipment

Slurry Mixing Equipment. The slurry seal mixing equipment shall be a continuous flow mixing unit, either an individual unit that returns to the stockpile for reloading or a continuous run unit that is resupplied on the job. All units must have a suitable means of accurately metering each individual material being fed into the mixer.

Slurry Spreading Equipment. The spreader box shall be equipped to prevent loss of slurry from the sides and should have a flexible rear strike-off. It shall be capable of producing a uniform surface over its full width.

Pneumatic-Tired Roller. Two-axled self-propelled roller with minimum uniform tire pressure of 50 PSI.

Auxiliary Equipment. Suitable crack and surface cleaning equipment, barricading equipment, hand tools and any support equipment necessary to perform work.

Material

Emulsified asphalt shall conform to requirements of specifications. Aggregates shall consist of natural or manufactured crushed stone such as granite, slay, limestone or other high quality aggregates or a combination.

Mineral filler shall consist of Portland Cement, hydrated lime, limestone dust, fly ash or other approved filler meeting requirements of specifications.

Water shall be potable and compatible with the slurry mix.

Personnel

Personnel familiar with the procedures of slurry seal application should be employed for slurry seal projects. At Castle AFB the work was contracted out to a slurry seal contractor.

Procedure

The general construction procedures to apply a slurry seal includes the following steps.

- a.* Remove and repair all structurally unsound pavements.
- b.* Fill cracks and joints wider than 1/8 in. with proper sealing material.
- c.* Clean pavement surface of all loose debris, silt spots, vegetation, oil spots and other objectionable material.
- d.* Apply slurry seal according to proper specifications.

Operation and Maintenance

Slurry seal is in itself basically considered a maintenance activity. By incorporating the correct techniques for slurry seal, it is estimated that maintenance costs can be reduced, and safety of vehicle and traffic can be increased.

Service and Support Requirements

No special services or support are required to implement or maintain this technology.

Performance Monitoring

Installation personnel can monitor and measure the performance of the slurry seal by conducting visual inspections of the area that has been sealed.

References

Godwin, L. N. (1975). "Slurry seal surface treatments," Instruction Report S-75-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

International Slurry Surfacing Association. (1986). "Recommended performance guidelines for emulsified asphalt slurry seal surfaces," Washington, DC.

U.S. Army Corps of Engineers. (1991). "Asphalt slurry seal," CEGS0251, Washington, DC.